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- USSR -

[A Translation]

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[A Translation]

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The systematic study of the drift of ice and marine currents is based on special drifting automatic radio-transmission stations (radio bearing pickets) sending periodic signals at pre-established time intervals.

The reception and direction-finding of the signals is carried out by coastal radio DF stations capable of taking the bearings (azimuths) to the operating radio pickets at distances of over 1,000 kilometers with an error of not more than $\pm 1.5^{\circ}$.

This permits keeping track of the movements of the radio picket and determining the direction and speed of the drift of ice or a marine current in the region of the picket.

The models of radio pickets of the 1956 vintage are equipped with a meteorometer (meteo-unit) designed for transmitting by radio the principal data on the direction and velocity of wind, temperature and pressure of air, and other information.

Radio pickets equipped with meteorometers operate in the Arctic Institute and are known under the name of "DARMS Alekseyeva" [Alekseyev's Drifting Automatic Radio Meteorological Station].

To determine the geographical coordinates of a radio picket, it is necessary to have on hand two bearings to that picket, taken by two coastal DF stations.

The processing of DF data is conducted, as a rule, by the analytic method. The "Guide to Observations of Currents" (Bibl. 1) recommends a scheme for the analytic processing of radio bearings based on the successive solving of three spherical triangles.

This scheme involves the use of six ponderous formulas, three of which are nonlogarithmic. In addition to tables of the logarithms of trigonometric functions, the processing of data on bearings also necessitates the use of tables of the logarithms of sums and differences.

The entire scope of work on computing the coordinates of a radio bearing picket includes 48 operations with logarithms. A drawback of this scheme of calculation is the great number of rules employed for determining the signs of the parameters entering in the formulas.

Below is cited an analytic method of determining the geographical coordinates of a drifting automatic radio-meteorological station through the parameters of two great circles on the terrestrial sphere, which method permits a much simpler solution of this problem.

The equations of the great circles passing through the sites of the coastal radio DF stations M_1 and M_2 and composing with the meridians of these stations angles equaling the observed orthodromic bearings P_1 and P_2 to the radio bearing picket can be written in the following form (Fig. 1):

$$\cos \omega_1 = \cos \varphi_{M_1} \sin P_1;$$

$$\operatorname{tg} (\lambda_{M_1} - \lambda_1) = \sin \varphi_{M_1} \operatorname{tg} P_1;$$

$$\cos \omega_2 = \cos \varphi_{M_2} \sin P_2;$$

$$\operatorname{tg} (\lambda_{M_2} - \lambda_2) = \sin \varphi_{M_2} \operatorname{tg} P_2.$$

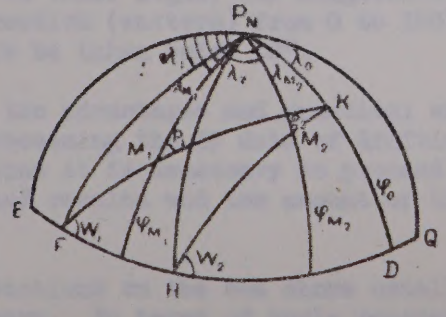

Fig. 1

Fig. 1

where ω_1 and λ_1 — are parameters of the great circle passing through the site of the coastal DF station M_1 ($\varphi_{M_1}; \lambda_{M_1}$) at an angle of P_1 to the meridian, and ω_2 and λ_2 are parameters of the great circle passing through the site of the coastal DF station M_2 ($\varphi_{M_2}; \lambda_{M_2}$) at an angle of P_2 to the meridian of that station.

To determine the geographical coordinates of the radio bearing picket ($\varphi_0; \lambda_0$), we obtain from the rectangular spherical triangles FKD and HKD:

$$\left.\begin{aligned} \operatorname{tg}\varphi_0 &= \sin(\lambda_0 - \lambda_1)\operatorname{tg}\omega_1 \\ \operatorname{tg}\varphi_0 &= \sin(\lambda_0 - \lambda_2)\operatorname{tg}\omega_2 \end{aligned}\right\}$$

On solving jointly these equations in relation to longitude λ_0 after uncomplicated transformations, the following formula is easily obtained:

$$\operatorname{tg}\left(\lambda_0 - \frac{\lambda_2 + \lambda_1}{2}\right) = \sin(\omega_2 + \omega_1)\operatorname{cosec}(\omega_2 - \omega_1)\operatorname{tg}\frac{\lambda_2 - \lambda_1}{2}.$$

During the comparison of the sums and differences of longitudes, to avert any errors in their signs, all longitudes can be regarded as in the clockwise direction (eastern) from 0 to 360°. The angles ω_1 and ω_2 should always be taken below 90°.

In evaluating the advantages and practical expediency of this or that method of processing the DF data of drifting automatic radiometeorological stations it is necessary to proceed from both the accuracy of the obtained results and the amount of time expended on the calculation.

The radio DF stations on the sea shore usually are spaced 200 to 300 kilometers apart. In terms of angle measure over the terrestrial sphere this amounts to 1°50' to 2°40'. In the analytic method recommended by the "Guide" (Bibl. 1) the distance between the radio

DF stations is calculated from the spherical triangle according to the formula of the cosine of a side. The calculations are, as a rule, based on quadruple-sign logarithmic tables. An error in calculating such small angle distances may reach 16' to 20'. Hence this is the order of magnitude of error that is to be expected when determining the geographical coordinates of a drifting automatic radio-meteorological station.

The above-offered method is free from this drawback, inasmuch as it excludes the requirement for calculating the distance betwen the coastal DF stations. The calculations are conducted according to logarithmic formulas only. The tables of the logarithms of sums and differences are unnecessary. The complete solution of the problem requires only 25 operations, i.e , nearly half as many as in the case of operations with logarithms. The rules for determining the signs of the parameters entering in the formulas are very simple.

Thus, from the standpoint of accuracy of calculations and expenditure of time, this method is tobe regarded as more expedient for processing the DF data of the drifting automatic radio-meteorological stations.

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1. Chaplygin, Ye. I. "Guide to Observations of Currents in Polar Stations and Observatories," Izd-vo Morskoy Transport, Moscow, 1957

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